

AMENDMENT UNDER 37 C.F.R. § 1.111
U.S. Appl. No. 09/836,236

forming reaction between the diazo compound and a coupler having a hydrogen atom at a coupling position thereof:

$$D\{\text{colorant}\}/dt = k \{\text{diazo compound}\} \quad \text{formula (1)}$$

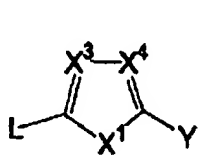
wherein k denotes the coupling reaction rate constant (s^{-1}), t denotes time (s), $\{\text{colorant}\}$ denotes a mole amount of the produced colorant, and $\{\text{diazo compound}\}$ denotes an initial mole amount of the diazo compound (mol).

2. (Amended) A method for forming an azo colorant, wherein a coupler having a leaving group at a coupling position thereof and a diazo compound are used, and the method has a coupling reaction rate constant k , measured by mixing equivalent amounts of an ethyl acetate solution containing an 8×10^{-5} mole concentration of the diazo compound and an ethyl acetate solution containing an 8×10^{-3} mole concentration of the coupler and a base with a stopped flow measurement device and by measuring change over time of an absorbance of the produced colorant and applying the resultant value to the following formula (1), of at least $0.1 s^{-1}$:

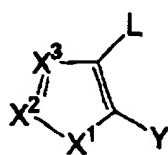
$$D \{\text{colorant}\}/dt = k\{\text{diazo compound}\} \quad \text{formula (1)}$$

wherein k denotes the coupling reaction rate constant (s^{-1}), t denotes time (s), $\{\text{colorant}\}$ denotes a mole amount of the produced colorant, and $\{\text{diazo compound}\}$ denotes an initial mole amount of the diazo compound (mol).

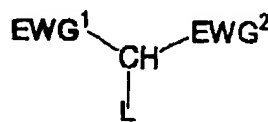
3. (Amended) The method for forming an azo colorant according to claim 1, wherein the coupler has a structure represented by one of the following general formulae (1), (2), (3), (4), and (5):



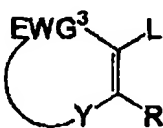
(1)



(2)



(3)



(4)

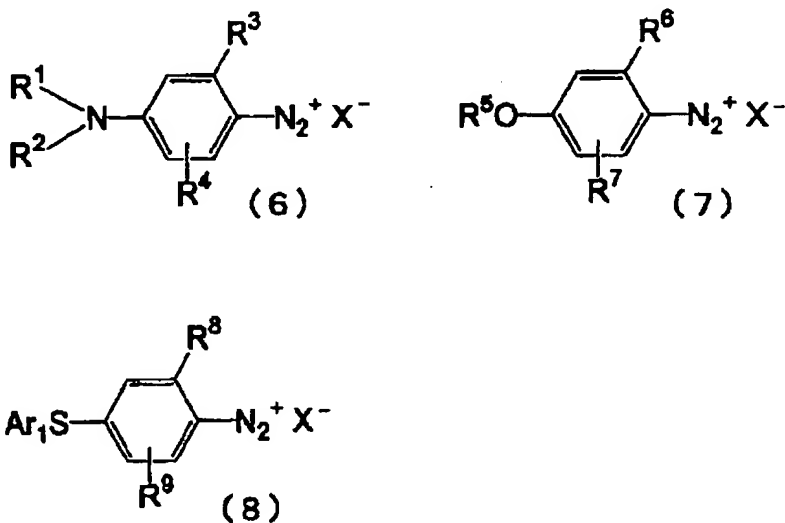


(5)

in which X^1 , X^2 , X^3 , and X^4 each independently represent an atomic group necessary for forming a five-membered aromatic heteroring; Y represents one of a hydroxyl group, an amino group which may have a substituent, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R represents one of a hydroxyl group, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an amino group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; Z represents one of a hydroxyl group and an amino group which may

have a substituent; Ar represents a benzene ring, naphthalene ring, pyridine ring or quinoline ring, each of which may have a substituent; L represents a substituent that is releasable at a time of coupling with the diazo compound; EWG¹, EWG² and EWG³ each independently represents an electron-attractive group; and X¹ and Y, EWG¹ and EWG², and Y and R may each link with each other to form a ring.

4. (Amended) The method for forming an azo colorant according to claim 3, wherein the diazo compound is a compound represented by one of the following general formulae (6), (7), and (8):

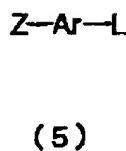
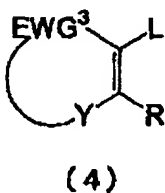
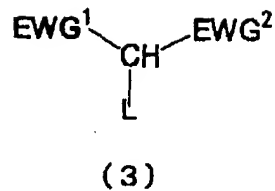
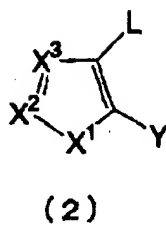
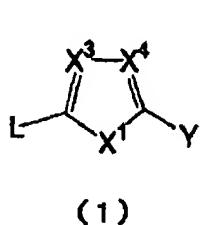


in which, in general formulae (6) and (7), R^1 and R^2 each represent one of a hydrogen atom and an alkyl group which may have a substituent; R^1 and R^2 may link with each other to form a heterocycle; R^1 and R^2 cannot both be hydrogen atoms; R^3 represents one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, an arylthio

group which may have a substituent, an alkylsulfonyl group which may have a substituent, and an arylsulfonyl group which may have a substituent; R^4 represents one of a hydrogen atom, an alkyl group which may have a substituent, and an alkoxy group which may have a substituent; R^5 represents one of a hydrogen atom and an alkyl group which may have a substituent; R^6 and R^7 each represent one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; R^6 and R^7 may be the same or different from each other; and X^- represents an acid anion, and

in the general formula (8), Ar^1 represents an aryl group which may have a substituent; R^8 and R^9 each represent one of an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R^8 and R^9 may be the same or different from each other; and X^- represents an acid anion.

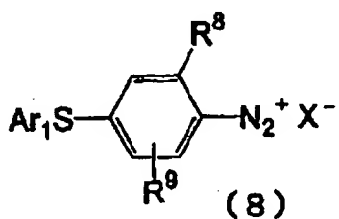
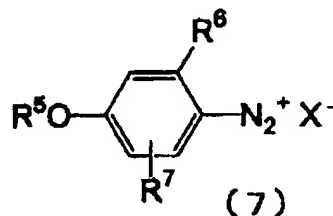
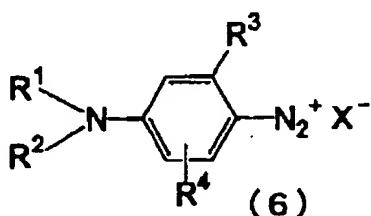
5. (Amended) The method for forming an azo colorant according to claim 2, wherein the coupler has a structure represented by one of the following general formulae (1), (2), (3), (4), and (5):



in which X^1 , X^2 , X^3 , and X^4 each independently represent an atomic group necessary for forming a five-membered aromatic heteroring; Y represents one of a hydroxyl group, an amino group which may have a substituent, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R represents one of a hydroxyl group, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an amino group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; Z represents one of a hydroxyl group and an amino group which may have a substituent; Ar represents a benzene ring, a naphthalene ring, a pyridine ring or a quinoline ring, each of which may have a substituent; L represents a substituent that is releasable at a time of coupling with the diazo compound; EWG^1 , EWG^2 and EWG^3 each independently represent an

electron-attractive group; and X^1 and Y, EWG¹ and EWG², and Y and R may each link with each other to form a ring.

6. (Amended) The method for forming an azo colorant according to claim 5, wherein the diazo compound is a compound represented by one of the following general formulae (6), (7), and (8):



in which, in general formulae (6) and (7), R^1 and R^2 each represent one of a hydrogen atom and an alkyl group which may have a substituent; R^1 and R^2 may link with each other to form a heterocycle; R^1 and R^2 cannot both be hydrogen atoms; R^3 represents one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, an arylthio group which may have a substituent, an alkylsulfonyl group which may have a substituent, and an arylsulfonyl group which may have a substituent; R^4 represents one of a hydrogen atom, an

a
alkyl group which may have a substituent, and an alkoxy group which may have a substituent; R^5 represents one of a hydrogen atom and an alkyl group which may have a substituent; R^6 and R^7 each represent one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; R^6 and R^7 may be the same or different from each other; and X^- represents an acid anion, and

in the general formula (8), Ar^1 represents an aryl group which may have a substituent; R^8 and R^9 each represent one of an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R^8 and R^9 may be the same or different from each other; and X^- represents an acid anion.

A4
Sub B2
13. (Amended) A recording material comprising a support and at least one recording layer disposed thereon containing a diazo compound and a coupler which reacts with the diazo compound for developing color, wherein the coupler has a leaving group at a coupling position thereof.

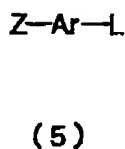
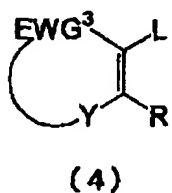
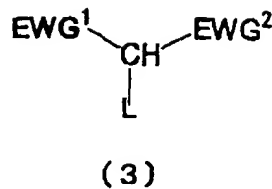
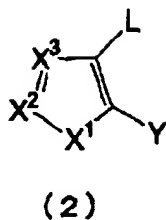
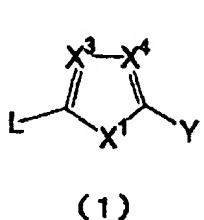
14. (Amended) A recording material comprising a support and at least one recording layer disposed thereon containing a diazo compound and a coupler which reacts with the diazo compound for developing color, wherein the coupler has a leaving group at a coupling position

thereof, the diazo compound and the coupler have a faster coupling reaction rate constant therebetween, measured by mixing equivalent amounts of an ethyl acetate solution containing an 8×10^{-5} mole concentration of the diazo compound and an ethyl acetate solution containing an 8×10^{-3} mole concentration of the coupler and a base with a stopped flow measurement device and by measuring change over time of an absorbance of the produced colorant and applying the resultant value to the following formula (1), than in a case of a coupler having a hydrogen atom at a coupling position thereof, and the coupling reaction rate constant k therebetween is at least 0.1 s^{-1} :

$$D \{\text{colorant}\}/dt = k \{\text{diazo compound}\} \quad \text{formula (1)}$$

wherein k denotes the coupling reaction rate constant (s^{-1}), t denotes time (s), $\{\text{colorant}\}$ denotes a mole amount of the produced colorant, and $\{\text{diazo compound}\}$ denotes an initial mole amount of the diazo compound (mol).

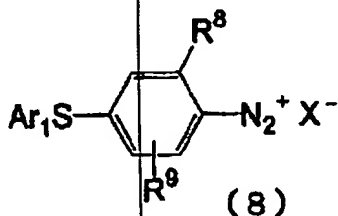
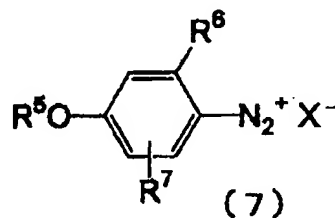
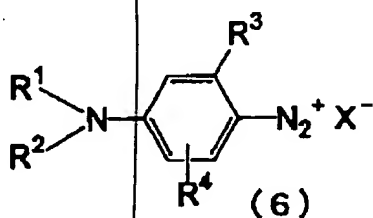
15. (Amended) The recording material according to claim 13, wherein the coupler has a structure represented by one of the following general formulae (1), (2), (3), (4), and (5):



in which X^1 , X^2 , X^3 , and X^4 each independently represent an atomic group necessary for forming a five-membered aromatic heteroring; Y represents one of a hydroxyl group, an amino group which may have a substituent, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R represents one of a hydroxyl group, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an amino group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; Z represents one of a hydroxyl group and an amino group which may have a substituent; Ar represents a benzene ring, a naphthalene ring, a pyridine ring or a quinoline ring, each of which may have a substituent; L represents a substituent that is releasable at a time of coupling with the diazo compound; EWG^1 , EWG^2 and EWG^3 each independently represent an

electron-attractive group; and X^1 and Y, EWG¹ and EWG², and Y and R may each link with each other to form a ring.

16. (Amended) The recording material according to claim 15, wherein the diazo compound is a compound represented by one of the following general formulae (6), (7), and (8):

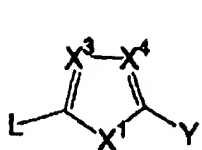


in which, in general formulae (6) and (7), R^1 and R^2 each represent one of a hydrogen atom and an alkyl group which may have a substituent; R^1 and R^2 may link with each other to form a heterocycle; R^1 and R^2 cannot both be hydrogen atoms; R^3 represents one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, an arylthio group which may have a substituent, an alkylsulfonyl group which may have a substituent, and an arylsulfonyl group which may have a substituent; R^4 represents one of a hydrogen atom, an alkyl group which may have a substituent, and an alkoxy group which may have a substituent; R^5

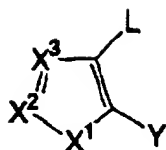
02
B
J
represents one of a hydrogen atom and an alkyl group which may have a substituent; R^6 and R^7 each represent one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; R^6 and R^7 may be the same or different from each other; and X^- represents an acid anion, and

in the general formula (8), Ar^1 represents an aryl group which may have a substituent; R^8 and R^9 each represent one of an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R^8 and R^9 may be the same or different from each other; and X^- represents an acid anion.

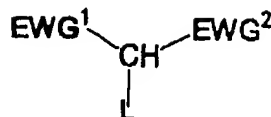
03
18. (Amended) The recording material according to claim 14, wherein the coupler has a structure represented by one of the following general formulae (1), (2), (3), (4), and (5):



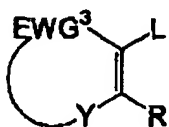
(1)



(2)



(3)



(4)

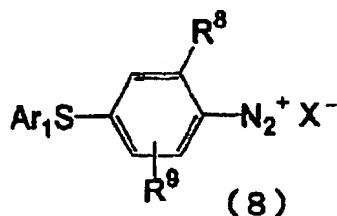
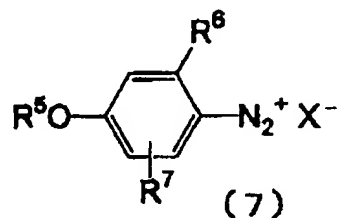
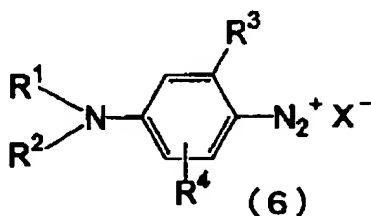


(5)

in which X^1 , X^2 , X^3 , and X^4 each independently represent an atomic group necessary for forming a five-membered aromatic heteroring; Y represents one of a hydroxyl group, an amino group which may have a substituent, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R represents one of a hydroxyl group, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an amino group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; Z represents one of a hydroxyl group and an amino group which may have a substituent; Ar represents a benzene ring, a naphthalene ring, a pyridine ring or a quinoline ring, each of which may have a substituent; L represents a substituent that is releasable at a time of coupling with the diazo compound; EWG^1 , EWG^2 and EWG^3 each independently represent an

electron-attractive group; and X^1 and Y, EWG¹ and EWG², and Y and R may each link with each other to form a ring.

19. (Amended) The recording material according to claim 18, wherein the diazo compound is a compound represented by one of the following general formulae (6), (7), and (8):



in which, in general formulae (6) and (7), R^1 and R^2 each represent one of a hydrogen atom and an alkyl group which may have a substituent; R^1 and R^2 may link with each other to form a heterocycle; R^1 and R^2 cannot both be hydrogen atoms; R^3 represents one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, an arylthio group which may have a substituent, an alkylsulfonyl group which may have a substituent, and an arylsulfonyl group which may have a substituent; R^4 represents one of a hydrogen atom, an alkyl group which may have a substituent, and an alkoxy group which may have a substituent; R^5

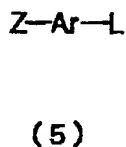
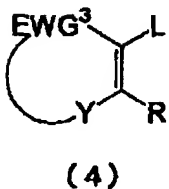
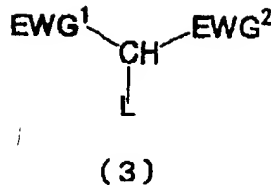
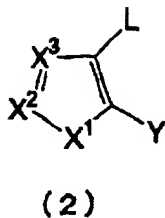
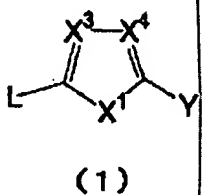
Q3 represents one of a hydrogen atom and an alkyl group which may have a substituent; R^6 and R^7 each represent one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; R^6 and R^7 may be the same or different from each other; and X^- represents an acid anion, and

in the general formula (8), Ar^1 represents an aryl group which may have a substituent; R^8 and R^9 each represent one of an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R^8 and R^9 may be the same or different from each other; and X^- represents an acid anion.

Please add the following new claims:

21. (New) A method for forming an azo colorant, wherein a coupler having a structure represented by one of the following general formulae (1), (2), (3), (4), and (5), and a diazo compound are used:

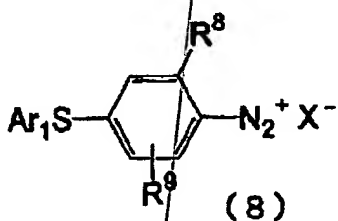
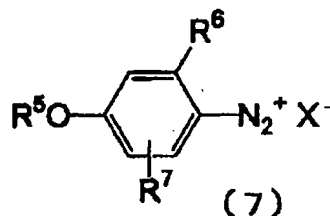
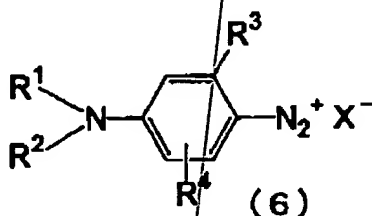
A4
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B4



in which X^1 , X^2 , X^3 , and X^4 each independently represent an atomic group necessary for forming a five-membered aromatic heteroring; Y represents one of a hydroxyl group, an amino group which may have a substituent, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R represents one of a hydroxyl group, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an amino group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; Z represents one of a hydroxyl group and an amino group which may have a substituent; Ar represents a benzene ring, a naphthalene ring, a pyridine ring or a quinoline ring, each of which may have a substituent; L represents a substituent that is releasable at a time of coupling with the diazo compound; EWG^1 , EWG^2 and EWG^3 each independently represent an

electron-attractive group; and X^1 and Y , EWG^1 and EWG^2 , and Y and R may each link with each other to form a ring.

22. (New) The method for forming an azo colorant according to claim 21, wherein the diazo compound is a compound represented by one of the following general formulae (6), (7), and (8):



in which, in general formulae (6) and (7), R^1 and R^2 each represents one of a hydrogen atom and an alkyl group which may have a substituent; R^1 and R^2 may link with each other to form a heterocycle; R^1 and R^2 cannot both be hydrogen atoms; R^3 represents one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, an arylthio group which may have a substituent, an alkylsulfonyl group which may have a substituent, and an arylsulfonyl group which may have a substituent; R^4 represents one of a hydrogen atom, an

b4
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alkyl group which may have a substituent, and an alkoxy group which may have a substituent; R⁵ represents one of a hydrogen atom and an alkyl group which may have a substituent; R⁶ and R⁷ each represents one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; R⁶ and R⁷ may be the same or different from each other; and X⁻ represents an acid anion, and

in the general formula (8), Ar¹ represents an aryl group which may have a substituent; R⁸ and R⁹ each represent one of an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R⁸ and R⁹ may be the same or different from each other; and X⁻ represents an acid anion.

23. (New) The method for forming an azo colorant according to claim 21, wherein a reducing agent is utilized.

24. (New) The method for forming an azo colorant according to claim 21, wherein a base is utilized.

25. (New) The method for forming an azo colorant according to claim 21, wherein, in the general formulae (1), (2), (3), (4), and (5), L is one of a halogen atom, an alkylthio group

af which may have a substituent, an arylthio group which may have a substituent, an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an arylsulfonyloxy group which may have a substituent, an acyloxy group which may have a substituent, a benzoyloxy group which may have a substituent, a dialkylaminocarbonyloxy group which may have a substituent, a diarylaminocarbonyloxy group which may have a substituent, an alkoxycarbonyloxy group which may have a substituent, an aryloxycarbonyloxy group which may have a substituent, an N-pyrazolyl group which may have a substituent, an N-imidazolyl group which may have a substituent, and an N-benzotriazolyl group which may have a substituent.

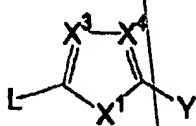
26. (New) The method for forming an azo colorant according to claim 22, wherein a reducing agent is utilized.

27. (New) The method for forming an azo colorant according to claim 22, wherein a base is utilized.

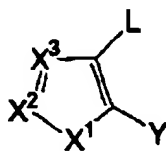
28. (New) The method for forming an azo colorant according to claim 22, wherein, in the general formulae (1), (2), (3), (4), and (5), L is one of a halogen atom, an alkylthio group which may have a substituent, an arylthio group which may have a substituent, an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group

which may have a substituent, an arylsulfonyloxy group which may have a substituent, an acyloxy group which may have a substituent, a benzoyloxy group which may have a substituent, a dialkylaminocarbonyloxy group which may have a substituent, a diarylaminocarbonyloxy group which may have a substituent, an alkoxy carbonyloxy group which may have a substituent, an aryloxy carbonyloxy group which may have a substituent, an N-pyrazolyl group which may have a substituent, an N-imidazolyl group which may have a substituent, and an N-benzotriazolyl group which may have a substituent.

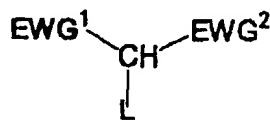
29. (New) A recording material comprising a support and at least one recording layer disposed thereon containing a diazo compound and a coupler which reacts with the diazo compound for developing color, wherein the coupler has a structure represented by one of the following general formulae (1), (2), (3), (4), and (5):



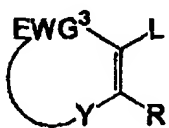
(1)



(2)



(3)



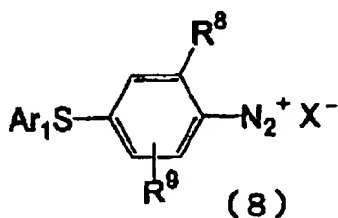
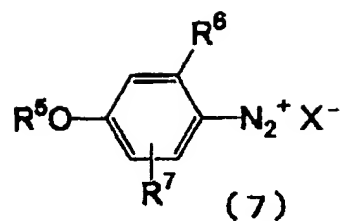
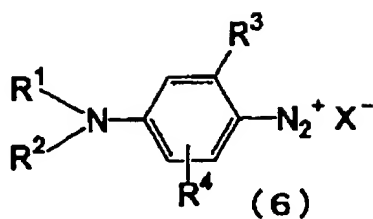
(4)



(5)

in which X^1 , X^2 , X^3 , and X^4 each independently represent an atomic group necessary for forming a five-membered aromatic heteroring; Y represents one of a hydroxyl group, an amino group which may have a substituent, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R represents one of a hydroxyl group, an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an amino group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; Z represents one of a hydroxyl group and an amino group which may have a substituent; Ar represents a benzene ring, a naphthalene ring, a pyridine ring or a quinoline ring, each of which may have a substituent; L represents a substituent that is releasable at a time of coupling with the diazo compound; EWG^1 , EWG^2 and EWG^3 each independently represent an electron-attractive group; and X^1 and Y, EWG^1 and EWG^2 , and Y and R may each link with each other to form a ring.

30. (New) The recording material according to claim 29, wherein the diazo compound is a compound represented by one of the following general formulae (6), (7), and (8):



in which, in general formulae (6) and (7), R^1 and R^2 each represent one of a hydrogen atom and an alkyl group which may have a substituent; R^1 and R^2 may link with each other to form a heterocycle; R^1 and R^2 cannot both be hydrogen atoms; R^3 represents one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, an arylthio group which may have a substituent, an alkylsulfonyl group which may have a substituent, and an arylsulfonyl group which may have a substituent; R^4 represents one of a hydrogen atom, an alkyl group which may have a substituent, and an alkoxy group which may have a substituent; R^5 represents one of a hydrogen atom and an alkyl group which may have a substituent; R^6 and R^7 each represent one of an alkyl group which may have a substituent, an alkoxy group which may have a substituent, an aryloxy group which may have a substituent, an alkylthio group which may have a substituent, and an arylthio group which may have a substituent; R^6 and R^7 may be the same or different from each other; and X^- represents an acid anion, and

in the general formula (8), Ar¹ represents an aryl group which may have a substituent; R⁸ and R⁹ each represent one of an alkyl group which may have a substituent, an aryl group which may have a substituent, an alkoxy group which may have a substituent, and an aryloxy group which may have a substituent; R⁸ and R⁹ may be the same or different from each other; and X⁻ represents an acid anion.

31. (New) The recording material according claim 29, wherein the diazo compound is contained in a microcapsule.

32. (New) The recording material according claim 30, wherein the diazo compound is contained in a microcapsule.
